Docket No.: 285507US0PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: GROUP: 1784

Tadaaki KANEKO, et al.

SERIAL NO: 10/566,652 EXAMINER: LANGMAN, JONATHAN C

FILED: June 28, 2006

FOR: TANTALUM CARBIDE, METHOD FOR PRODUCING TANTALUM CARBIDE, TANTALUM CARBIDE WIRING AND TANTALUM CARBIDE ELECTRODE

DECLARATION UNDER 37 C.F.R. § 1.132

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

Sir:

Now comes Satoshi TORIMI who deposes and states that:

1. I am a graduate of Graduate School of Kwansei Gakuin University and received my Master degree in the year 2008.

2. I have been employed by Toyo Tanso for 2 years and 8 months as an assistant researcher.

3. I am familiar with the above-captioned patent application, of which Toyo Tanso Co. LTD is the assignee.

4. I have reviewed and understood the Office Action dated September 16, 2010 and I have read and understood the contents of Douglass et al (US 3,163,563), Lopez et al (US 5,916,377) and Garg et al (US 5,126,206).

5. The following experiments were carried out by me or under my direct supervision and control.

Four Ta base materials were subjected to thermal treatments for removing Ta_2O_5 on the surfaces thereof, under the conditions shown in Table 1 below. After the treatments, carburization was performed for each sample. The results are shown in Table 2 below and in Reference Drawing attached hereto.

Table 1.

	Temp. [°C]	Pressure	Period (hr)
No. 1	1850	Vacuume	4
No. 2	2000	Vacuume	4
No. 3	2100	Vacuume	4
No. 4	2150	Vacuume	4

Table 2.

	Carburized amount [g]	C [g]	O [g]	Ta [g]	C/Ta
No. 1	0.003	10.29	30.34	59.37	0.17
No. 2	0.013	44.85	2.04	53.1	0.84
No. 3	0.028	50.48	2.82	46.69	1.08
No. 4	0.47	46.73	1.69	51.57	0.91

Table 2 shows the carburized amount (an amount of C immersed into Ta base material) and the element content of the post-carburization tantalum carbide layer in each sample. The element content of the tantalum carbide layer was measured by EPMA (electron probe microanalyzer). The Reference Drawing enclosed provides SEM inspection images of the surface of the post-carburization tantalum carbide layer of each sample. The image of each sample shows a "Three-Fold Symmetrical Structure" where the Three-Fold Symmetrical Structure indicates a circularly symmetrical structure where a shape of the structure matches a shape of the structure rotated by 120 or by 240 degree, e.g., a regular triangle.

In No. 1, removal of Ta_2O_5 formed on the Ta base material surface was insufficient because the temperature for the thermal treatment of the Ta base material was low. Resultantly, a small carburized amount was present in the carburization layer as shown in Table 2. The resultant tantalum carbide layer contained a large amount of oxygen due to the presence of Ta_2O_5. Consequently, the purity of the tantalum carbide layer was low because the insufficient removal of Ta_2O_5 hindered favorable progress of carburization. Furthermore, as shown in the Reference Drawing, the growth of the tantalum carbide was poor and the tantalum carbide layer barely included fibrous tantalum crystals (see Reference Drawing No. 1, particularly the image of 200x).

To the contrary, in No. 2 to No. 4, the Ta_2O_5 on the Ta base material surface was sufficiently removed because the temperature of the thermal treatment for the Ta base material was high enough. The content of oxygen in the surface was very little. As shown in Reference Drawing No. 2 - No. 4, a highly pure and fine tantalum carbide layer containing sufficiently grown tantalum carbide crystals was formed.

As described above, carburizing a Ta base material or the like does not necessarily and/or inherently result in formation of a tantalum carbide layer having fibrous crystals (tantalum carbide crystals grown) as in the present invention. Furthermore, there is a chance of failing to obtain a highly pure Ta film. A highly pure tantalum carbide layer having fibrous crystals (tantalum carbide crystals grown) is obtained when Ta_2O_5 is sufficiently removed from the Ta base material prior to carburization (see specification page 24 line to page 25, line 4). The references cited disclose no more than formation of a tantalum layer on a base material. It is very much likely that the TaC layers in the references do not contain TaC layers including fine fibrous crystals as in the present invention. It is my opinion, based on the examples above and the examples of the specification, that a tantalum carbide material of the above-captioned patent application should not have been foreseen based on the disclosures of the references cited.

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Declaration under 37 C.F.R. 1.132

6. The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

Satoshi Tomii
Signature

December 14, 2010
Date

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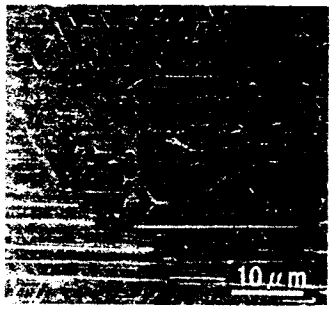
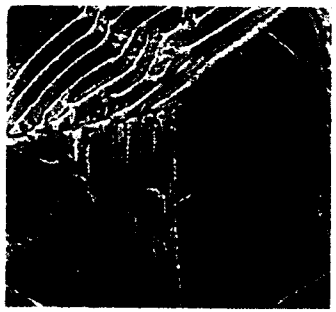
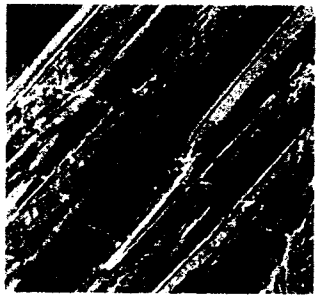
REFERENCE DRAWING

THREE-FOLD SYMMETRICAL STRUCTURE

FIBROUS STRUCTURE

INSUFFICIENT REMOVAL OF TANTALUM OXIDE FILM TA_2O_5 TEMPERATURE RANGE

SUFFICIENT REMOVAL OF TANTALUM OXIDE FILM TA_2O_5 TEMPERATURE RANGE

	No.1 1850℃	No.2 2000℃	No.3 2100℃	No.4 2150℃
VACUUM (MAGNIFICATION ×3000)				
VACUUM (MAGNIFICATION ×200)